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de Bijl, P.W.J.

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**DELEGATION OF RESPONSIBILITY
IN ORGANIZATIONS**

by Paul W.J. De Bijl

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Delegation of Responsibility in Organizations

Paul W.J. De Bijl*

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Abstract

I explore a principal-agent relationship in which the agent enjoys exerting effort, and the principal appeals to the agent's sense of job satisfaction. The principal can either impose a project, or delegate the choice of a project to the agent. The agent has to incur a cost for learning his ex ante unknown preferences among the projects. The optimal delegation scheme is determined by the tradeoff between more discretion (higher probability that the agent proposes his preferred project and exerts high effort) and less discretion (principal can impose his preferred project). The principal can write a contract with a third party (e.g. an investor, or the firm's CEO) that makes commitment to the delegation scheme credible.

Keywords: Delegation, Empowerment, Organizations; *JEL Classification:* L23.

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1 Introduction

The principal-agent literature studies optimal reward structures for an agent who dislikes exerting effort (see Hart and Holmström [7] for a survey). Typically in this literature, the principal either does not know the agent's productivity, or cannot observe how hard the agent is working (and it is impossible to make exact inferences *ex post* by observing realized output or profits). The principal's problem is then to maximize profits by designing an optimal "carrot," that is, a pecuniary incentive scheme that induces (given the informational constraints) the agent to work as hard as possible.

In this paper, I explore a principal-agent relationship in which the agent enjoys exerting effort (at least to some extent), and the principal may optimally appeal to the agent's sense of job satisfaction (or more generally, the agent's private benefits, as opposed to using pecuniary rewards). Among a number of candidate projects, only one can be executed by the agent. The principal can either impose a project, or delegate the choice of a project to the agent. The agent's preferences among the projects are *ex ante* unknown, and he has to incur a private cost in order to learn them. The principal can motivate the agent to get informed by giving him responsibility to choose among a large enough number of projects. Since the agent is intrinsically motivated by private benefits, discretion for the agent also benefits the principal: the agent exerts maximal effort on his pet project.¹

Thus, the model analyzes empowerment of the agent in an agency relationship. The following quote illustrates the main question: "The issue [...] is where to draw the line around responsibilities and [...] freedom. I agree that it's important to delegate responsibility and empower people throughout the organization, but you also have to communicate clearly what the boundaries are around their jobs." (Poole, in Continental Bank [3], p. 50.)

¹Thus, a special feature of the model is that initially there is symmetric information between the parties, and only the agent has the ability to acquire information such that an asymmetry is created. By delegating responsibility, the principal can give the agent incentives to create an asymmetry of information.

In the model, the principal selects an optimal delegation scheme for the agent by evaluating the following tradeoff. On the one hand, giving the agent little discretion in project choice results in a lack of initiative: the agent has no incentive to learn his private benefits. The principal's most preferred project is implemented, but the agent exerts an intermediate level of effort. On the other hand, much discretion in project choice results in initiative: the agent will get informed and recommend his preferred project. The selected project may be suboptimal for the principal, but the agent exerts a maximum level of effort.

In order to have an incentive to collect information, the agent may need an amount of discretion that is larger than the principal would give him if getting informed would be costless. In this case the agent's proposal need not be optimal ex post, although the delegation scheme is optimal ex ante. Accordingly, it may happen that after receiving the agent's recommendation for a project, the principal has an incentive to break his promise to follow up the proposal. As was already noticed by Schelling [11], a means to make commitment possible is to write a contract with a third party. Here, when profits are contractable, profit-sharing with a third party (e.g. an investor, or the organization's CEO) can give the principal incentives not to abuse his authority after the agent's recommendation. It is shown that a renegotiation-proof contract with a third party, implying an incentive scheme for the principal, can solve the credibility problem of the principal with regard to his agent.

The reason why the principal and the third party may refrain from renegotiating is that there is an informational asymmetry.² At the time of renegotiation (the interim stage), the principal knows the agent's proposal, but the investor does not. The contract turns out to be such that the investor cannot infer the agent's recommendation at the interim stage. Hence the investor is not sure whether there is an allocative gain when renegotiating, or the principal tries to realize a gain at the investor's disadvantage. The con-

²Dewatripont [6] showed (in a model in which an incumbent firm signs labour contracts to deter entry) that if there exist informational asymmetries, writing a contract with a third party may result in credible commitment.

tract is renegotiation-proof (i.e., interim efficient, see Maskin and Tirole [9]) when the investor cannot gain in expectation from renegotiating.

My agency model postulates that intrinsic rewards (e.g. job satisfaction, challenge, a sense of accomplishment and achievement) are effective motivators. As argued by Dessler [5], "Few rewards are as powerful as the sense of accomplishment and achievement that come from doing a job that one genuinely wants to do [...]," (p. 254). Moreover, it may be that extrinsic motivators (e.g. money) have little or an adverse effect. Actually, there is a debate going on in the management literature in which performance-related pay is under heavy fire.³ One of the basic objections is that "[...] workers are much more influenced by [...] the intrinsic interest of their work than by crass material rewards." (*The Economist*, January 29th 1994, p. 69.) Furthermore, besides that there are non-negligible costs of implementing payment schemes, it is put forward that they may demotivate people. The intention of this paper is not to participate in this debate, but instead to complement the existing principal-agent literature by investigating how a principal can motivate his subordinate if pecuniary incentive schemes are too costly or have no or little effect. An example is a researcher. If he is fascinated by a research topic, he will automatically work hard, probably much harder than he would do on a project that does not interest him. It is then practically impossible to make him work harder by designing a payment scheme contingent on, say, the number of papers he writes (even when quality is verifiable). An appendix demonstrates this more formally.

Related to this paper is Aghion and Tirole [1]. They study endogenous separation of formal authority (the right to choose a project) and real authority (the effective choice of a project). A principal and an agent each incur a cost to get informed about his own private benefits of a number of projects, and only one project can be chosen. Their preferences may not be aligned. The principal can credibly delegate real authority to the agent by not having incentives to get informed himself. In this case the agent's incentives to get

³See for instance Kohn [8], and the references to empirical evidence cited therein.

informed increase, but the principal's ^{new} formal authority decreases. An alternative way to give the agent an incentive to learn the projects' payoffs is to "make the agent his own boss," that is, allocate formal authority to the agent by disintegration.

The differences with Aghion and Tirole [1] are first, in my model the principal's concern is the amount of discretion that he should delegate to the agent, instead of whether he should get informed himself, or split up the firm. Second, after selection of a project, the principal's payoffs depend on how hard the agent works. Thus, giving the agent discretion alleviates two moral hazard problems: it creates initiative to get informed and recommend a project, and it induces high effort.

Athey et al. [2] analyze the allocation of decisions (e.g. about the production volume) among two agents (e.g. a foreman and a manager), in an organization that faces uncertainty (e.g. concerning demand conditions and defective output of machines). In different states of the world, the agents differ in their relative decision-making effectiveness (due to for instance differences in talent, but also because the quality of an agent's decision is reduced as the number of states over which he has discretion increases). In the first stage of the model, a subset of the possible states has to be chosen; in the second stage, a state is realized by nature and a decision must be made. If the state is in that set, then the foreman makes the decision; otherwise, the manager decides.⁴ The allocation of discretion is chosen in order to maximize the overall organization's benefits. Besides the different focus of their paper (the allocation of discretion under uncertainty), a major difference with my model is that Athey et al. do not consider incentive problems between a principal and an agent.

The model is presented in the following section. The principal's delegation decision is analyzed in section 3. The commitment problem (if any) is investigated in section 4. Finally, section 5 concludes. An appendix demon-

⁴Thus one can distinguish between "hands-off" management (or "management by exception") and "meddlesome" management, as determined by the number of states of the world in which the manager makes the decision.

strates why it may be much more effective to appeal to the agent's intrinsic motivation rather than use pecuniary rewards.

2 The Organization

Consider a hierarchy (or organization) that consists of a principal called P , and an agent called A . The hierarchy can implement only one out of $n \geq 2$ possible projects. The principal's role is to either pick a project or delegate the choice of a project to the agent. Once a project has been selected, the agent executes (or implements) it.

The principal's benefits of project k , which will also be called profits, are denoted by $\Pi_k(e)$, where $e \geq 0$ is the agent's effort in executing the project. The effort of the agent may be observable, and even verifiable. However, it will not be included in a contract (see below).

Assumption 1 $\Pi_k(e)$ (i) is decreasing in k , for all e ; (ii) is strictly increasing in e , for all k ; and (iii) satisfies $\Pi_k(e) > 0$, for all k and $e > 0$.

Thus for a given effort level, the principal's preferred project is project 1. Also, all the projects are profitable.

The agent derives benefits $U(b_k, e) \geq 0$ from project k , where b_k denotes his private benefits of project k , and $e \geq 0$ is again his effort level. Private benefits are directly related to a project (intrinsic rewards), and may include job satisfaction, challenge, and a sense of accomplishment and achievement. However, one can also think of perks on the job, the acquisition of professional experience, career concerns, and so on.

Assumption 2 $U(b, e)$ (i) is strictly increasing in b , for all e ; (ii) is strictly concave in e , for all b ; and (iii) satisfies $\frac{\partial^2 U(b, e)}{\partial b \partial e} > 0$.

By assumption 2 (iii), the agent's optimal effort level is increasing in the level of his private benefits.

Nature selects b_1, \dots, b_n according to a distribution $\Pr(b_i = \bar{b} \text{ and } b_j = \underline{b}, \forall j \neq i) = \alpha_i$, where $\sum_i \alpha_i = 1$ and $\bar{b} > \underline{b} \geq 0$. Thus there is one most-preferred project for the agent; he is indifferent among the other projects.⁵

The realization of A 's private benefits can only be observed by A . However, he has to incur a private cost $F > 0$ to do so. Whether A gets informed is assumed to be unverifiable. For instance, a scientist, whose private benefits depend on the originality of his work, has to choose among research topics. He can get informed by going through recent literature to see which project is the most promising one.⁶

I investigate how the agent can be induced to exert effort by allowing him to enjoy private benefits. To simplify the analysis, it will be assumed that the agent receives a constant wage equal to his reservation wage, which is normalized to zero. One can justify this assumption in different ways. First, money may be a bad motivator. For instance, the agent is infinitely risk averse to income. Second, a fixed wage may be imposed externally. For example, the hierarchy is part of a larger organization in which the CEO finds it too costly to condition salaries on all possible contingencies that occur "way down" in the hierarchy. It may also be that fixed wages are due to labor union influence. Consequently, the agent's effort level will not be included in a contract.⁷ As argued in an appendix, abstracting from pecuniary incentive schemes does not affect generality when the agent is relatively more responsive to intrinsic motivation than to extrinsic incentives.

The principal's delegation decision is expressed by a mechanism (x_1, \dots, x_n) , where $x_i \in [0, 1]$ for all $i = 1, \dots, n$. If A recommends project k , then this project will be implemented with probability x_k , and project 1 will be im-

⁵This assumption simplifies the analysis; it is not crucial for the results.

⁶Alternatively, F is the cost of scanning the labor market for career opportunities: once the agent has incurred F , he immediately sees which project he prefers. The fact that F is independent of the number of projects simplifies the analysis without loss of generality.

⁷If the agent responded to monetary incentives, the principal could increase the agent's incentives (i) to observe his private benefits and recommend a project, and (ii) to exert effort (see also Aghion and Tirole [1]).

plemented with probability $1 - x_k$. So

$$x_k = \Pr(\text{project } k \text{ is implemented} \mid A \text{ proposed project } k).$$

For instance, $x_1 = 1$ and $x_2 = \dots = x_n = 0$ corresponds to P imposing his preferred project, that is, project 1. If $x_1 = \dots = x_n = 1$ then A has complete responsibility: any project that A recommends will be implemented.⁸

The timing of the game is as follows:

- $t = 0$: Nature selects A 's private benefits, unobserved by P and A . P chooses $x_i \in [0, 1]$, $i = 1, \dots, n$, and communicates (x_1, \dots, x_n) to A .
- $t = 1$: A decides whether to learn his private benefits (at cost F).
- $t = 2$: A recommends a project k to P .
- $t = 3$: Project k is selected with probability x_k , and project 1 is selected with probability $1 - x_k$. Subsequently, A picks an effort level e to execute the selected project.

An additional assumption will be made in order to make the analysis non-trivial:

Assumption 3 (i) If $(x_1, \dots, x_n) = (1, 0, \dots, 0)$ then A decides not to learn his private benefits, and
(ii) if $(x_1, \dots, x_n) = (1, \dots, 1)$ then A decides to learn his private benefits.

Examples. Consider benefit functions $\Pi_k(e) = p(e)B_k$, and $U(b, e) = p(e)b - e$. The values of the projects to P satisfy $B_1 > \dots > B_n > 0$. Furthermore, $p(\cdot)$ is increasing and concave, $p(0) = 0$ and $\lim_{e \rightarrow \infty} p(e) = 1$. Three interpretations are:

1. *Production*: The agent realizes the production, and derives private benefits from producing a particular product. The principal sells the

⁸More generally, one could define $x_{ki} = \Pr(\text{project } i \text{ is implemented} \mid A \text{ proposed } k)$. A delegation scheme would then be a matrix $(\underline{x}_1, \dots, \underline{x}_n)$, where $\underline{x}_k = (x_{k1}, \dots, x_{kn})'$. One can verify that the optimal delegation scheme would satisfy $x_{ki} = 0$ for all $i \neq 1, k$.

product. B_k is the willingness to pay for a product of type k by a potential customer, given that it completely meets her wishes. In this context $p(e)$ denotes product quality. Accordingly, producing a “perfect” product ($p(e) = 1$) is extremely costly for the agent, and the client is willing to pay $p(e)B_k$ for a product of quality $p(e)$.

2. *Marketing*: The agent performs marketing activities for an existing product, and derives private benefits from being active in a particular market. B_k denotes the size of market k (all consumers, in each market, have a reservation price 1 for the product). Here $p(e)$ is the fraction of the market that is reached as a result of exerting marketing effort e .
3. *R&D*: The agent is the researcher, and derives private benefits from realizing a particular innovation. An innovation of type k has patent value B_k . Given an effort level e , an innovation k occurs with probability $p(e)$.

3 Optimal Delegation

To begin with, some additional notation is introduced. Let $\bar{e} \equiv \arg \max_e U(\bar{b}, e)$ (the agent’s optimal effort level for a high private-benefits project), $\underline{e} \equiv \arg \max_e U(\underline{b}, e)$ (optimal effort for a low private-benefits project), and $e_i^0 \equiv \arg \max_e \{\alpha_i U(\bar{b}, e) + (1 - \alpha_i) U(\underline{b}, e)\}$ (optimal effort when the agent is uninformed about project i ’s private benefits). Furthermore, denote $\bar{u} \equiv U(\bar{b}, \bar{e})$, $\underline{u} \equiv U(\underline{b}, \underline{e})$, and $u_i^0 \equiv \alpha_i U(\bar{b}, e_i^0) + (1 - \alpha_i) U(\underline{b}, e_i^0)$. Note that by assumption 2, $\bar{e} > e_i^0 > \underline{e}$ and $\bar{u} > u_i^0 > \underline{u}$ for all i .

Assumption 3 can equivalently be written as

$$\underline{F} \equiv \alpha_1 \bar{u} + (1 - \alpha_1) \underline{u} - u_1^0 < F \leq \bar{u} - u_1^0 \equiv \bar{F}, \quad (1)$$

that is, the cost of learning private benefits is sufficiently high so that A does not care about observing b_1 if project 1 is imposed, and the cost is sufficiently low so that he has an incentive to observe his private benefits if he has complete discretion.

The equilibrium of the game is calculated by backward induction. Suppose that project k is selected at $t = 3$. Two cases can be distinguished:

- (i) A knows the value of b_k . If $b_k = \bar{b}$ then A exerts effort \bar{e} . If $b_k = \underline{b}$ then A exerts effort \underline{e} .
- (ii) A does not know the value of b_k . He exerts effort e_k^0 .

At $t = 2$, A recommends a project. Given that he did not observe his private benefits, I will assume that he acts in P 's interest and recommends project 1 (this will be the case if $\alpha_1 \geq \alpha_j$ for all $j = 2, \dots, n$).⁹ This is equivalent to giving A the possibility to make no recommendation, after which P will pick his preferred project. If A knows his private benefits, then he recommends project k if and only if $b_k = \bar{b}$. Thus the incentive compatibility constraints are trivially satisfied.

Setting $x_1 = 1$ (note that this does not impose any restrictions), A will learn his private benefits at $t = 1$ if and only if

$$\sum_{k=1}^n \alpha_k (x_k \bar{u} + (1 - x_k) \underline{u}) - F \geq u_1^0,$$

equivalent to

$$\sum_{k=1}^n \alpha_k x_k (\bar{u} - \underline{u}) \geq F + u_1^0 - \underline{u}. \quad (2)$$

The principal's delegation problem at $t = 0$ can be split into two problems. The first one is the optimal choice of (x_1, \dots, x_n) , denoted by (x'_1, \dots, x'_n) , given that A learns his private benefits:

$$\max_{x_1, \dots, x_n} \sum_{k=1}^n \alpha_k [x_k \Pi_k(\bar{e}) + (1 - x_k) \Pi_1(\underline{e})] \quad (3)$$

$$\text{s.t.} \quad \sum_{k=1}^n \alpha_k x_k (\bar{u} - \underline{u}) \geq F + u_1^0 - \underline{u},$$

$$0 \leq x_i \leq 1, i = 1, \dots, n.$$

⁹This assumption simplifies the exposition without loss of generality.

The second problem is the optimal choice of (x_1, \dots, x_n) , denoted by (x_1^0, \dots, x_n^0) , under the restriction that A is not willing to incur the observation cost:

$$\max_{x_1, \dots, x_n} \Pi_1(e_1^0) \quad (4)$$

$$\text{s.t.} \quad \sum_{k=1}^n \alpha_k x_k (\bar{u} - \underline{u}) < F + u_1^0 - \underline{u},$$

$$0 \leq x_i \leq 1, i = 1, \dots, n.$$

Let Π^{inf} denote the optimal value of problem (3). The implicit form of its solution is given in the following lemma:

Lemma 3.1 *Problem (3) is solved by a delegation scheme $(x'_1, \dots, x'_n) = (1, \dots, 1, x'_\ell, 0, \dots, 0)$, for some $x'_\ell \in [0, 1]$ and $\ell \in \{2, \dots, n\}$ such that (2) holds with equality if $\Pi_\ell(\bar{e}) < \Pi_1(\underline{e})$.*

Proof: Problem (3) can be solved in a simple way (optimality of the derived solution can be verified immediately with the Duality Theorem of linear programming). P will select $x'_1 = 1$, because $\Pi_1(\bar{e}) > \Pi_1(\underline{e})$. Moreover, since $\Pi_k(\bar{e}) - \Pi_1(\underline{e})$ is decreasing in k , there exists an $m \in \{1, \dots, n\}$ such that

$$\Pi_i(\bar{e}) \geq \Pi_1(\underline{e}) \text{ for all } i = 1, \dots, m,$$

and

$$\Pi_i(\bar{e}) < \Pi_1(\underline{e}) \text{ for all } i = m + 1, \dots, n.$$

Accordingly, P sets $x'_i = 1$ for all $i = 1, \dots, m$. There are two possibilities:

- (i) Inequality (2) is satisfied if $x'_i = 0$ for all $i = m + 1, \dots, n$. The problem is solved.
- (ii) Inequality (2) is not satisfied if $x'_i = 0$ for all $i = m + 1, \dots, n$. By assumption 3 (ii), there exists an $\ell \in \{m + 1, \dots, n\}$ such that (2) holds if $x'_i = 1, i = m + 1, \dots, \ell$ and $x'_i = 0, i = \ell + 1, \dots, n$. However, since setting $x'_i > 0$ is ex post costly for P if A recommends a project

$i \in \{m+1, \dots, \ell\}$, P will set $x'_\ell \in (0, 1]$ such that (2) is binding, that is,

$$x'_\ell = \frac{F + u_1^0 - \underline{u} - \sum_{i=1}^{\ell-1} \alpha_i(\bar{u} - \underline{u})}{\alpha_\ell(\bar{u} - \underline{u})}. \quad (5)$$

Accordingly, the problem is solved. \square

The intuition behind lemma 3.1 is as follows. If A , who is informed about his private benefits, recommends a project k with $\Pi_k(\bar{e}) \geq \Pi_1(\underline{e})$, then the proposal will be accepted by P . In this case P cares more about A 's effort than about his own preferences when comparing project k with project 1. However, in order to give A an incentive to observe his private benefits, it may be necessary that P also accepts some "bad" projects, that is, projects for which $\Pi_k(\bar{e}) < \Pi_1(\underline{e})$. Of course, P will accept as few bad projects as possible: A is given no more incentives than necessary, that is, (2) holds with equality (given that it is optimal for P to include some bad projects in A 's choice set).

By assumption 3, problem (4) is trivially solved by giving A no discretion, that is, $(x_1^0, \dots, x_n^0) = (1, 0, \dots, 0)$. Accordingly, the agent has no incentive to learn his private benefits.

The solution of P 's problem at $t = 0$, denoted by (x_1^*, \dots, x_n^*) , is found by comparing the values of Π^{inf} and $\Pi_1(e_1^0)$. In particular, the responsibility delegated by the principal to the agent satisfies

$$x_i^* = \begin{cases} x'_i, & i = 1, \dots, n \text{ if } \Pi^{inf} \geq \Pi_1(e_1^0), \\ x_i^0, & i = 1, \dots, n \text{ otherwise.} \end{cases}$$

Delegating responsibility only makes sense if $\Pi^{inf} \geq \Pi_1(e_1^0)$, that is, it is (expectedly) profitable. In this case, P wants A to get informed. The analysis is summarized in the following proposition.

Proposition 3.1 *(i) If $\Pi^{inf} \geq \Pi_1(e_1^0)$ then P selects a delegation scheme $(1, \dots, 1, x'_\ell, 0, \dots, 0)$ for some $\ell \geq 2$ (see lemma 3.1); A will learn his private benefits and propose his preferred project.*

(ii) If $\Pi^{inf} < \Pi_1(e_1^0)$ then P selects delegation scheme $(1, 0, \dots, 0)$; P imposes his preferred project and A will not learn his private benefits.

The intuition behind proposition 3.1 is straightforward. When selecting A 's optimal delegation scheme, P faces a tradeoff between giving A more or less discretion. Little discretion in project choice results in a lack of initiative: A has no incentive to learn his private benefits. P 's most preferred project is implemented, but A exerts an intermediate level of effort. Much discretion in project choice results in initiative: A will learn his private benefits and recommend his preferred project. The selected project may be suboptimal for P , but A exerts a maximum level of effort.

Accordingly, authoritative management has the effect of demotivating the agent. On the other hand, the consequences of empowerment of the agent (or "hands-off" management) are that the agent's incentives (i) to get informed and make a proposal, and (ii) to work hard on the proposed project increase.

For an expositional purpose, one can define the agent's amount of discretion as

$$X \equiv \frac{1}{n} (x_1^* + \dots + x_n^*).$$

Notice that $X \in [\frac{1}{n}, 1]$. Accordingly, a higher level of X corresponds to more responsibility for A . We have that $X = \frac{1}{n}$ corresponds to no discretion, and $X = 1$ to total freedom.

What role does the agent's cost of getting informed play? If (2) is not binding, which is typically the case for low values of F , a small increase in F has no influence on X . By inspection of (5) it follows that for larger values of F , constraint (2) is binding and X is strictly increasing in F . This reflects that A may need more discretion to have an incentive to learn his private benefits. However, this is only true as long as Π^{inf} does not drop below $\Pi_1(e_1^0)$. An increase in F that is sufficiently large will result in $\Pi^{inf} < \Pi_1(e_1^0)$, so that A loses all his responsibility. Let this threshold level of F be denoted by \tilde{F} . Figure 1 demonstrates the dependence between F and X .

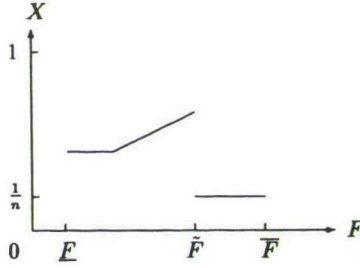


Figure 1 Empowerment (X) and the cost of getting informed (F).

Example 3.1 Let $\Pi_k(e) = p(e)B_k$, and $U(b, e) = p(e)b - e$, where $B_1 > \dots > B_n > 0$, $p(\cdot)$ is increasing and concave, and satisfies $p(0) = 0$ and $\lim_{e \rightarrow \infty} p(e) = 1$. There are three possible projects. Suppose that $F = (\alpha_1 + \alpha_2)\bar{u} + \alpha_3\underline{u} - u_1^0$ and $p(\bar{e})B_3 < p(\underline{e})B_1$.

Straightforward calculations yield that $(x'_1, x'_2, x'_3) = (1, 1, 0)$ and $\Pi^{inf} = \alpha_1 p(\bar{e})B_1 + \alpha_2 p(\bar{e})B_2 + \alpha_3 p(\underline{e})B_1$. Furthermore, $(x_1^0, x_2^0, x_3^0) = (1, 0, 0)$ and $\Pi_1(e_1^0) = p(e_1^0)B_1$. If $\alpha_1 p(\bar{e})B_1 + \alpha_2 p(\bar{e})B_2 + \alpha_3 p(\underline{e})B_1 \geq p(e_1^0)B_1$ then the optimal delegation scheme is $(x_1^*, x_2^*, x_3^*) = (1, 1, 0)$. Accordingly, the agent finds it worthwhile to learn the private benefits of the different projects, so that he can recommend his preferred project.

In the analysis above it was implicitly assumed that the principal can commit himself to a delegation scheme. To see why this assumption is needed, consider example 3.1 and suppose P is not able to commit himself. Let $p(\bar{e})B_2 < p(\underline{e})B_1$, that is, if the agent recommends project 2, the principal ex post prefers project 1. However, the optimal scheme $(x_1^*, x_2^*, x_3^*) = (1, 1, 0)$ suggests that the agent's recommendation will be followed up by the principal. Thus there is a time-consistency problem. The following result follows from inspection of problem (3):

Proposition 3.2 *If P cannot commit himself to follow up the agent's recommendation, then only delegation schemes (x_1^*, \dots, x_n^*) that satisfy $x_k^* >$*

$0 \Leftrightarrow \Pi_k(\bar{e}) \geq \Pi_1(\underline{e})$ are credible. Accordingly, credible commitment may be necessary for delegation of responsibility.

It is obvious that lack of commitment may hurt both the principal and the agent. In example 3.1, without commitment, only the "no delegation" scheme $(x_1^*, x_2^*, x_3^*) = (1, 0, 0)$ is credible. Accordingly, the principal's expected profits are $\Pi_1(e_1^0)$, lower than the expected profits Π^{inf} that could be obtained under commitment. It is easy to construct examples in which the agent strictly prefers to have enough discretion so that he will get informed.

The higher is the agent's cost of getting informed, F , the more discretion the agent needs to have an incentive to take initiative. Therefore it will be clear that (in general) commitment problems are more severe when F is higher.

4 Credible Commitment

In this section I will assume that the principal cannot commit himself to carry out a promise that is suboptimal *ex post*. If a court could enforce delegation schemes, there would be no problem: given a proposal k while $x_k^* = 1$, the agent would never agree on implementing a project $i \neq k$. Thus, the principal has a credibility problem only if a court cannot prevent the principal from forcing the agent to implement a certain project. The purpose of this section is to find a solution to this credibility problem¹⁰ given that the principal cannot rely on a court to protect the agent's discretion (a possible justification is that project implementation is not verifiable by outsiders). Indeed, casual empirical observation suggests that if a principal fails to comply with an earlier promise, the agent often has no power to react.

¹⁰An obvious solution is to give the principal the possibility to build up a reputation for following up recommendations. Accordingly, if some project k with $\Pi_k(\bar{e}) < \Pi_1(\underline{e})$ is proposed by A , P faces a tradeoff between: (i) imposing the superior project 1 and decreasing A 's future incentives to recommend projects, and (ii) following up the recommendation and increasing A 's future incentives to recommend projects. See Tirole [13], chapter 6, for a survey of the theory of repeated interaction.

Suppose that the principal has the possibility to sign a contract on profit sharing with a risk-neutral third party, called S (e.g. an investor, or the organization's CEO). The main question is then whether the optimal delegation scheme when commitment is possible (as derived in the previous section) can be implemented. The contract with S should give the principal incentives to carry out a delegation scheme after any proposal by the agent.

Throughout this section it will be assumed that $\Pi^{inf} > \Pi_1(e_1^0)$, and that there exists at least one project k such that $x_k^* > 0$ and $\Pi_k(\bar{e}) < \Pi_1(\underline{e})$. Also, $n \geq 3$ will be needed. By proposition 3.2, there is a time-consistency problem: if A recommends such a project k , P has an incentive to break his promise by imposing project 1.

The organization's profits are assumed to be contractable. At the time of delegating responsibility to A , P has the possibility to write a contract on profit-sharing with S . S is not able to verify which project is implemented (since he cannot observe or verify implementation), so that the choice of a project is noncontractable. I assume that S is willing to sign any contract that gives him non-negative net payoffs. An explanation is that S competes in a Bertrand fashion with other agents.

What kind of contracts with a third party can one think of? A possible interpretation is that S is an investor who purchases a financial contract. For instance, the principal may issue shares with the particularity that the dividend percentage varies with the realized profits (as we will see later). An alternative interpretation is that S is the firm's CEO, that is, the principal's principal.

A 's project recommendation is private information for P . One can think of a situation in which S does not communicate with people on the workforce, and vice versa. For instance, if S is an investor this situation corresponds to casual empirical observation. A possible explanation is that the costs for workers and investors to find and subsequently get in touch with one another are too high (see also footnote 15). Alternatively, if S is the CEO, he may simply have no time to talk with the principal's subordinate because of overload. Consequently, there is only communication between A and P ,

and between P and S .

S 's payoffs of the contract, as a function of profits, are denoted by $D(\Pi)$ for any possible profit level $\Pi \in V \equiv \{\Pi_i(e)\}_{e=\bar{e}, \underline{e}}^{i=1, \dots, n}$. I will assume that there is limited liability for P and S . The price at which P sells the contract is denoted by $p \geq 0$ (so formally, a contract consists of a profit-sharing rule as a function of profits, and a price p). For example, p is the price of a financial contract. If a contract is sold, p is added to any future profits.¹¹ Thus we have

$$0 \leq D(\Pi) \leq \Pi + p, \quad \forall \Pi \in V. \quad (6)$$

Let (x_1^*, \dots, x_n^*) be the optimal delegation scheme under the assumption that commitment is possible (as derived in the previous section). The purpose of selling a contract is to align P 's ex ante and ex post incentives. Since P cares about profits after paying S , the following incentive-compatibility constraint must be satisfied. For all k that satisfy $x_k^* > 0$ and $\Pi_k(\bar{e}) < \Pi_1(\underline{e})$:

$$\Pi_k(\bar{e}) - D(\Pi_k(\bar{e})) \geq \Pi_1(\underline{e}) - D(\Pi_1(\underline{e})). \quad (7)$$

The contract with S will be required to be renegotiation-proof. At the renegotiation stage, S makes P a take-or-leave-it offer. This assumption plays a simplifying role: signaling problems and multiplicity of equilibria are avoided because S 's proposal does not reveal any information.¹² Thus S has full bargaining power at this stage, but P can always insist on sticking to the initial contract (because it is binding). The purpose of renegotiating is to have P impose project 1 after any recommendation k with $\Pi_k(\bar{e}) < \Pi_1(\underline{e})$ by A .

The contract will be called renegotiation-proof if and only it is interim efficient. The payoffs specified by a contract are interim efficient (relative to

¹¹For instance, the principal can put p on a bank account without access until profits are realized. Moreover, I assume that he has no other resources to put into escrow.

¹²Maskin and Tirole [9] have shown that if "strong" renegotiation proofness is the appropriate definition of renegotiation proofness, then it does not matter who has the bargaining power at the renegotiation stage, i.e., the set of ex ante implementable allocations when the uninformed party has all the bargaining power is the same when the informed party has full bargaining power.

the prior beliefs) if (i) they are incentive compatible, and (ii) there exists no other incentive compatible allocation that Pareto dominates it, and yields S at least as much expected utility (Maskin and Tirole [9]).

S 's renegotiation offer consists of a menu of new contract payoffs (to replace the old payoffs $D(\Pi)$)

$$\{d_i(\Pi)\}_{\Pi \in V}, i = 1, \dots, n,$$

where i denotes P 's announcement of A 's recommendation. By the Revelation Principle, restricting S 's offer to a direct-revelation mechanism is without loss of generality.¹³

We have the following timing:

$t = 0$: P sells a contract to S at price p , with payoffs specified as a function of profits. This contract is observed by A . Nature selects A 's private benefits. P communicates (x_1^*, \dots, x_n^*) to A .

$t = 1$: A decides whether to learn his private benefits (at cost F).

$t = 2$: A recommends a project to P .

$t = 3$: S proposes P to renegotiate.

$t = 4$: P accepts or rejects S 's offer, and executes the corresponding delegation scheme. A picks an effort level to implement the selected project. Profits are realized and the contract between P and S is executed.

To keep the analysis as simple as possible without hurting the insights, I will focus on the case $n = 3$ such that if commitment was possible, P would select $(x_1^*, x_2^*, x_3^*) = (1, 1, 0)$, while $\Pi_2(\bar{e}) < \Pi_1(\underline{e})$ (cf. example 3.1). The following proposition identifies the set of renegotiation-proof allocations.

Proposition 4.1 *The contract between P and S is renegotiation-proof if and only if*

$$D(\Pi_1(\underline{e})) - D(\Pi_2(\bar{e})) \geq \frac{\alpha_2 + \alpha_3}{\alpha_3} (\Pi_1(\underline{e}) - \Pi_2(\bar{e})). \quad (8)$$

¹³See for instance Myerson [10].

Proof: I will say that the principal has type k if project k was recommended by the agent. The only relevant incentive-compatibility constraint for the initial contract's payoffs is¹⁴

$$\Pi_2(\bar{e}) - D(\Pi_2(\bar{e})) \geq \Pi_1(\underline{e}) - D(\Pi_1(\underline{e})). \quad (9)$$

Since there is no allocative gain ex post and no incentive problem if the agent recommends project 1, any proposal by S satisfies $d_1(\Pi_1(\bar{e})) = D(\Pi_1(\bar{e}))$. Moreover, the proposal is incentive compatible if and only if

$$d \equiv d_2(\Pi_1(\underline{e})) = d_3(\Pi_1(\underline{e})). \quad (10)$$

To see this, suppose that (10) does not hold. It is immediate that type $j = \arg \max_{j=2,3} d_j(\Pi_1(\underline{e}))$ would mimic the other type.

It must be that (9) holds with strict inequality. If this were not the case, then S could propose $d = D(\Pi_2(\bar{e})) + \Pi_1(\underline{e}) - \Pi_2(\bar{e})$ and gain in expectation $\alpha_2(\Pi_1(\underline{e}) - \Pi_2(\bar{e}))$. Since $\Pi_1(\underline{e}) - d = \Pi_2(\bar{e}) - D(\Pi_2(\bar{e}))$, the offer would be accepted by P .

Suppose that type 2 accepts S 's offer, that is,

$$\Pi_1(\underline{e}) - d \geq \Pi_2(\bar{e}) - D(\Pi_2(\bar{e})).$$

Since (9) holds with strict inequality, this in turn implies that type 3 also accepts. So necessarily, by proposing to renegotiate, S runs the risk that he is dealing with type 3 instead of type 2. Interim efficiency means that S is not willing to take this gamble. There does not exist an incentive-compatible allocation such that S is strictly better off in expectation compared to the initial allocation if and only if for all $d \leq D(\Pi_2(\bar{e})) + \Pi_1(\underline{e}) - \Pi_2(\bar{e})$:

$$\alpha_1 D(\Pi_1(\bar{e})) + \alpha_2 D(\Pi_2(\bar{e})) + \alpha_3 D(\Pi_1(\underline{e})) \geq \alpha_1 d_1(\Pi_1(\bar{e})) + \alpha_2 d + \alpha_3 d.$$

Equivalently,

$$D(\Pi_1(\underline{e})) - D(\Pi_2(\bar{e})) \geq \frac{\alpha_2 + \alpha_3}{\alpha_3} (\Pi_1(\underline{e}) - \Pi_2(\bar{e})). \quad \square$$

¹⁴Other incentive-compatibility constraints can trivially be satisfied; see the proof of proposition 4.2.

The basic idea of the proof of proposition 4.1 is to show the following. Suppose S makes a proposal to renegotiate. If P accepts when A has proposed project 2 (this is the only case in which there are mutual gains from renegotiation for P and S), then necessarily he also accepts the renegotiation offer when A has recommended project 3. Moreover, S is not able to make an offer such that he is able to distinguish between project proposals 2 and 3.¹⁵ This means that renegotiating is “risky” for S , in the sense that the fact that P accepts his offer is not informative about whether the “size of the pie” can be increased. Renegotiation-proofness amounts to designing the initial contract such that the expected loss of renegotiation for S outweighs the expected gain.

One can interpret (8) directly by rewriting it as

$$\alpha_3[T(\Pi_2(\bar{\varepsilon})) - T(\Pi_1(\underline{\varepsilon}))] \geq \alpha_2[\Pi_1(\underline{\varepsilon}) - \Pi_2(\bar{\varepsilon})], \quad (11)$$

where $T(\Pi) \equiv \Pi - D(\Pi)$ for all $\Pi \in V$, that is, $T(\cdot)$ denotes profits after paying S . Inequality (11) says that the “expected bribe” to be offered to the principal by S (in order to make him accept the renegotiation offer) exceeds the expected gains that can be divided after the agent’s proposal to implement project 2 is not followed up.

Observation of inequality (8) sheds some light on the role of the prior distribution of A ’s private benefits. The lower bound for $D(\Pi_1(\underline{\varepsilon})) - D(\Pi_2(\bar{\varepsilon}))$ (as given by the renegotiation-proofness requirement) is increasing in α_2 , the probability that A prefers project 2: the interim-efficiency constraint

¹⁵Direct communication between the agent and the third party would not help the latter. If the agent could commit himself not to talk with S , he would certainly do so, because renegotiation is bad for him. However, suppose the agent cannot commit, and S tries to verify the principal’s announcement by asking the agent about his preferred project. The only way for S to make the agent reveal his preferences is to promise to implement the agent’s preferred project with positive probability (instead of adopting delegation scheme $(1, 0, 0)$). But then, once the agent has revealed, S no longer has an incentive to carry out such a randomization. Indeed, assuming that S is able to commit himself to carry out suboptimal promises, and not able to commit not to renegotiate, would at least be very questionable.

becomes more stringent if the probability that there are gains from renegotiating increases. Additionally, the interim-efficiency constraint becomes less stringent if α_3 increases, that is, the expected cost of renegotiation increases.

Now that the renegotiation-proof allocations are identified, the principal's problem of optimal contract design can be formulated. In the following program, the last three constraints are incentive-compatibility constraints. Notice that (8) implies that if A proposes project 2, P has no incentive to impose project 1. So incentive-compatibility constraint (7) is automatically satisfied.

$$\max_{p, D(\Pi), \forall \Pi \in V} p + \sum_{k=1}^2 \alpha_k [\Pi_k(\bar{\epsilon}) - D(\Pi_k(\bar{\epsilon}))] \quad (12)$$

$$+ \alpha_3 [\Pi_1(\underline{\epsilon}) - D(\Pi_1(\underline{\epsilon}))]$$

$$\begin{aligned} \text{s.t.} \quad & \alpha_1 D(\Pi_1(\bar{\epsilon})) + \alpha_2 D(\Pi_2(\bar{\epsilon})) + \alpha_3 D(\Pi_1(\underline{\epsilon})) \geq p, \\ & D(\Pi_1(\underline{\epsilon})) - D(\Pi_2(\bar{\epsilon})) \geq \frac{\alpha_2 + \alpha_3}{\alpha_3} (\Pi_1(\underline{\epsilon}) - \Pi_2(\bar{\epsilon})), \\ & 0 \leq D(\Pi) \leq \Pi + p, \quad \forall \Pi \in V, \\ & p \geq 0, \\ & \Pi_1(\bar{\epsilon}) - D(\Pi_1(\bar{\epsilon})) \geq \Pi - D(\Pi), \quad \Pi = \Pi_2(\underline{\epsilon}), \Pi_3(\underline{\epsilon}), \\ & \Pi_2(\bar{\epsilon}) - D(\Pi_2(\bar{\epsilon})) \geq \Pi_3(\underline{\epsilon}) - D(\Pi_3(\underline{\epsilon})), \\ & \Pi_1(\underline{\epsilon}) - D(\Pi_1(\underline{\epsilon})) \geq \Pi - D(\Pi), \quad \Pi = \Pi_2(\underline{\epsilon}), \Pi_3(\bar{\epsilon}). \end{aligned}$$

Does there exist a solution to program (12) such that S 's participation constraint (the first constraint in the program) is binding? A direct observation is that P 's expected profits equal Π^{inf} if and only if the contract's expected net returns are zero (because any returns come from realized profits). The answer to the question, which is the main result of this section, is given in the following proposition.

Proposition 4.2 *There exists a renegotiation-proof contract with price p^* and returns $D^*(\Pi)$, $\forall \Pi \in V$, such that (i) $(x_1^*, x_2^*, x_3^*) = (1, 1, 0)$ is implemented, (ii) S purchases the contract, and (iii) P 's expected profits are equal to Π^{inf} .*

Proof: Let $D^*(\Pi_1(\bar{e})) = \Pi_1(\bar{e})$, $D^*(\Pi_2(\bar{e})) = 0$, and $D^*(\Pi_1(\underline{e})) = \frac{\alpha_2 + \alpha_3}{\alpha_3}(\Pi_1(\underline{e}) - \Pi_2(\bar{e}))$. Choose p^* such that S 's participation constraint is binding, i.e., $p^* = \alpha_1 \Pi_1(\bar{e}) + (\alpha_2 + \alpha_3)(\Pi_1(\underline{e}) - \Pi_2(\bar{e}))$. It is straightforward to check that all the constraints of program (12) are satisfied. Trivially, P 's profits equal $\alpha_1 \Pi_1(\bar{e}) + \alpha_2 \Pi_2(\bar{e}) + \alpha_3 \Pi_1(\underline{e}) = \Pi^{inf}$. To complete, $D^*(\Pi) = \Pi + p^*$ for $\Pi \in \{\Pi_2(\underline{e}), \Pi_3(\bar{e}), \Pi_3(\underline{e})\}$ satisfy the limited liability constraints and also the remaining incentive compatibility constraints. \square

By proposition 4.2, P can credibly commit himself to the optimal delegation scheme that induces A to get informed. Selling a renegotiation-proof contract to an outside party convinces the agent that he can rely on the delegation scheme. Moreover, since the expected return stream of the contract is equal to its price, the principal is not worse off compared to the case in which commitment was simply assumed to be possible. Basically, the analysis explains a manager's incentive scheme as a solution to a credibility problem of the manager with regard to his subordinate.

In inequality (11) one can observe that the principal's net profit function resulting from the contract with the third party, $T(\Pi)$, is necessarily non-monotonic. Therefore, one has to assume that the principal has no possibility to "throw away" profits $\Pi_1(\underline{e}) - \Pi_2(\bar{e})$. A justification for such an assumption is that wasting money may be easily detected and punished.

When profit-wasting activities are difficult to discern, the non-monotonicity property of the principal's net profit function may be unappealing. However, one should keep in mind that the purpose of the contract with the third party is to create congruence of the principal's and the agent's incentives. In a more elaborate model, one can imagine that the principal cares about the agent's job satisfaction (the "smile on the agent's face"). Congruence may then be achieved by a low-powered incentive scheme, such as $T(\Pi) = c$ for all Π . Thus low-powered incentives may be preferred over high-powered incentives in firms for reasons of incentives-alignment.¹⁶

¹⁶Williamson [14] identifies different motives for using low-powered incentive schemes in firms: he argues that high-powered incentives may give rise to asset utilization losses and

5 Conclusion

In this paper I investigate a principal-agent relationship in which the principal gives the agent an incentive to exert effort by considering the latter's private benefits (e.g. job satisfaction). The principal can do so by giving the agent responsibility to select a project (among a certain number of projects). If the agent has enough discretion, he finds it worthwhile to learn his private benefits of the possible projects, and recommend his preferred one. Delegation of responsibility may benefit the principal because the agent will work hard if he is allowed to implement his preferred project.

The principal can solve commitment problems (if any) to follow up the agent's recommendation by attracting a third party, such as an outside investor. Profit-sharing with this party allows the principal, who cares about net profits, to align his incentives before and after the agent's project proposal. The contract can be designed such that its price is equal to the expected return stream, so that commitment problems can be costlessly solved.

The principal-agent model studied in this paper is relatively simple, and can be used as a building block for models to investigate more complex issues. For instance, in De Bijl [4], I study strategic delegation of responsibility in firms competing on a product market. The firms' managers compete by simultaneously giving their subordinates discretion to select (horizontal) product location. A subordinate produces the good that is subsequently sold by his manager.

The agency relationship of my model (in which the agent cares about his private benefits) and the standard principal-agent model (with monetary incentive schemes) are two extreme cases. An interesting generalization of the model, outside the scope of this paper, would be to endogenize the principal's choice between giving the agent intrinsic or extrinsic rewards, and to analyze the tradeoff that is involved.

accounting manipulations.

Appendix

This appendix aims at developing some intuition for the kind of agency relationships to which the model applies. Consider the following model, adapted from the main model: there is one possible project (say project 1), and the (risk-neutral) agent derives utility w if he receives a wage $w \geq 0$. The cost of getting informed is relatively high, so that the agent has no incentive to learn his private benefits if he has no say in the project choice (assumption 3 (i)).

Without any salary, A 's optimal effort level is e_1^0 , resulting in expected benefits u_1^0 , and profits $\Pi_1(e_1^0)$ (the notation is defined in section 3). Suppose that the profit or effort level is contractable. Then A can be induced to exert effort $e > e_1^0$ if he is compensated with a payment scheme

$$w(\Pi) = \begin{cases} u_1^0 - [\alpha_1 U(\bar{b}, e) + (1 - \alpha_1)U(\underline{b}, e)], & \text{if } \Pi = \Pi_1(e), \\ 0, & \text{otherwise.} \end{cases}$$

P will select a payment scheme to implement an optimal effort level according to

$$\max_{e, w(\Pi)} \Pi_1(e) - w(\Pi)$$

$$\text{s.t.} \quad w(\Pi) = u_1^0 - [\alpha_1 U(\bar{b}, e) + (1 - \alpha_1)U(\underline{b}, e)].$$

Assuming an interior solution, the optimal effort level e^* that P wants to implement satisfies

$$\frac{\partial \Pi_1(e^*)}{\partial e} = -\alpha_1 \frac{\partial U(\bar{b}, e^*)}{\partial e} - (1 - \alpha_1) \frac{\partial U(\underline{b}, e^*)}{\partial e}, \quad (13)$$

accompanied by a wage $w(\Pi_1(e^*)) = u_1^0 - \alpha_1 U(\bar{b}, e^*) - (1 - \alpha_1)U(\underline{b}, e^*)$.

Suppose that P pays no wage. If α_1 is small, A 's effort level will be low, that is, e_1^0 will be relatively close to \underline{e} . Moreover, if $\Pi_1(e)$ is relatively "flat" around e_1^0 , then there P can offer A only limited monetary compensation for exerting more effort than e_1^0 . Thus, giving the agent a salary on top of his reservation wage hardly increases profits at the optimum (and e^* will exceed e_1^0 only a little). To see this, observe the first-order condition (13).

If $\partial \Pi_1(e^*)/\partial e$ tends to 0, we obtain the first-order condition that determines e_1^0 .

Now suppose that private benefits are very important to the agent, so that a high private-benefits project induces relatively high effort compared to e_1^0 , \underline{e} and e^* . In particular, if A knows that $b_1 = \bar{b}$, then $\Pi_1(\bar{e}) > \Pi_1(e^*) - w(\Pi_1(e^*))$. Typically, there may exist a range of projects $1, \dots, m$ such that

$$\Pi_i(\bar{e}) > \Pi_1(e^*) - w(\Pi_1(e^*)), \text{ for all } i = 1, \dots, m,$$

and inducing a higher effort level than \bar{e} by a wage scheme is hindered by limited means (the profit function is even flatter around \bar{e}). It will be clear that in this case, appealing to the agent's sense of job satisfaction is much more effective than using a monetary incentive scheme.

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